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ABSTRACT

To clarify computer literacy needs in teacher education, this study focused on the determination of computer literacy course offerings in higher education institutions, the perceived skills a computer literate teacher should possess, and discrepancies between teacher perceptions and computer literacy course offerings. Results were used to develop a model plan for teacher education in computer literacy. Information was solicited from 177 computer-using teachers and 12 National Council for the Accreditation of Teacher Education Institutions (NCATE) in Colorado, Montana, and Wyoming. Eight institutions returned computer literacy course materials and other information for content analysis, and 135 teachers (76.8%) returned 4-part questionnaires covering demographics, elements or skills of computer literacy (as developed for the 1978 Baum study), general topics in educational computer use, and additional information regarding computer literacy instruction. Results showed significant differences in the content of courses presently offered for computer literacy and the perceived need of inservice teachers for course content. This report includes the three-page model course plan for institutions, which outlines the components necessary to meet the computer literacy needs of inservice and preservice teachers. (LMM)

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COMPUTER LITERACY: A MODEL PLAN FOR TEACHER EDUCATION IN THE AREA OF INSTRUCTIONAL APPLICATIONS OF COMPUTERS

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SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

It could probably be said that the three most important technological achievements during the past 25 years were Sputnik, Neil Armstrong's walk on the moon, and the invention of the silicon computer chip. Each space accomplishment in its own way had a profound but different effect on the society and the institutions of society, including the educational system. The country is in the midst of another dramatic revolution brought about by the development of the computer chip. This transformation has the potential of eclipsing the previously mentioned events---one which has ramifications that are reverberating throughout the society. The age of the computer is now!

Educational systems have always been given the responsibility of preparing students to take their place as productive citizens in the society. As technology improves and changes, at an ever increasing rate, it becomes more difficult for educational institutions to prepare their students to cope with life. Society's demand for more, better, faster, has placed a significant additional burden on the traditional system. The impact of the computer has been tremendous. Its scope reaches from calculating mathematics

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to processing words for the poet. Its appeal seems to have no age limit--from video games for children to powerful computing for the businessman. Its breadth is no longer confined to the scientific community. Now, there exist automobiles with computerized monitoring systems, microwave ovens with programmable memories which allow for an infinite variety of selections, talking banking machines--the list goes on; new items are added each day. It is a machine with which to be reckoned. In the right hands, the computer can be a power tool of the mind--a tool which can improve man's quality of life.

It is important for the society as a whole to know the capabilities and limitations of this complex machine. That responsibility falls for the most part on the educational system. How the educational community will confront the problem of what teachers need to be taught about computer literacy needs to be clarified. What components comprise computer literacy? What is the current condition of teaching computer literacy in higher education? Answers to these questions are needed as a <u>focus</u> for the development of plans which will incorporate the teaching of the new technology in a manner which is comprehensive and consistent.

The problem in this study was to: (1) determine the content of the computer literacy course offerings of selected higher education institutions, (2) determine the perceived skills a computer literate teacher should possess,

(3) determine the discrepancy between the teacher's perceptions of those skills and the skills taught in courses offered by the selected institutions, and (4) develop a model plan which will ensure the attainment of the necessary computer literacy skills.

The study involved the three states of Colorado, Montana, and Wyoming. The two major populations sampled were computer using teachers in the three states and the NCATE (National Council for the Accreditation of Teacher Education) institutions in those states as well.

In selecting teacher subjects, the primary criterion was to choose those individuals who were currently using computers in an educational setting. This included individuals who were teaching computer science or teachers who were using the computer to enhance, augment, or complement their academic program. These individuals were referred to for the purposes of this study as "inservice teachers." They were identified by their affiliation with teacher computer user groups within their respective states. The population sample consisted of 50 participants from Wyoming, 54 from Montana, and 73 from Colorado. Thus a total of 177 computer using educators were requested to participate in the study.

The criterion for institutional participation was that the college or university be an accredited NCATE institution from the three states of Colorado, Montana, and Wyoming. A

total of 12 institutions were asked to participate in the study.

The questionnaire, which the teacher participants were asked to complete, consisted of a cover letter and four parts. The first part dealt with the demographics of the population including age, sex, grade level taught, number of years teaching experience, number of years using a computer for instructional purposes, and the number of semester hours training in computers the respondent had. Part II was based primarily on the elements or skills of computer literacy which were developed in the Baum Study (1978) of computer literacy skills. The respondents were asked to rank these skills and knowledge for computer literacy on a five-point Likert scale. The rating levels were (1) not needed, (2) should be covered, but in a second course, (3) needed only if time permits, (4) should probably be included, and (5) definitely needed. The five-point scale was chosen because of its inherent statistical preference as well as its appropriate number of levels for this particular set of questions. In Part III of the survey instrument, an attempt was made to rank the importance of 12 general topics in educational computer use. The responses were based on the educator's perception of their importance. Part IV requested the participants to contribute any additional information they wished with respect to the teaching of computer

literacy. There were 135 respondents to the questionnaire, for a return percentage of 76.8.

NCATE institutions were initially contacted by letter and asked to participate in the study. They were then asked to supply the course syllabus, outlines, and any other pertinent information which would allow for a close examination of actual content in courses which were scheduled as computer literacy courses. Eight institutions responded to the study.

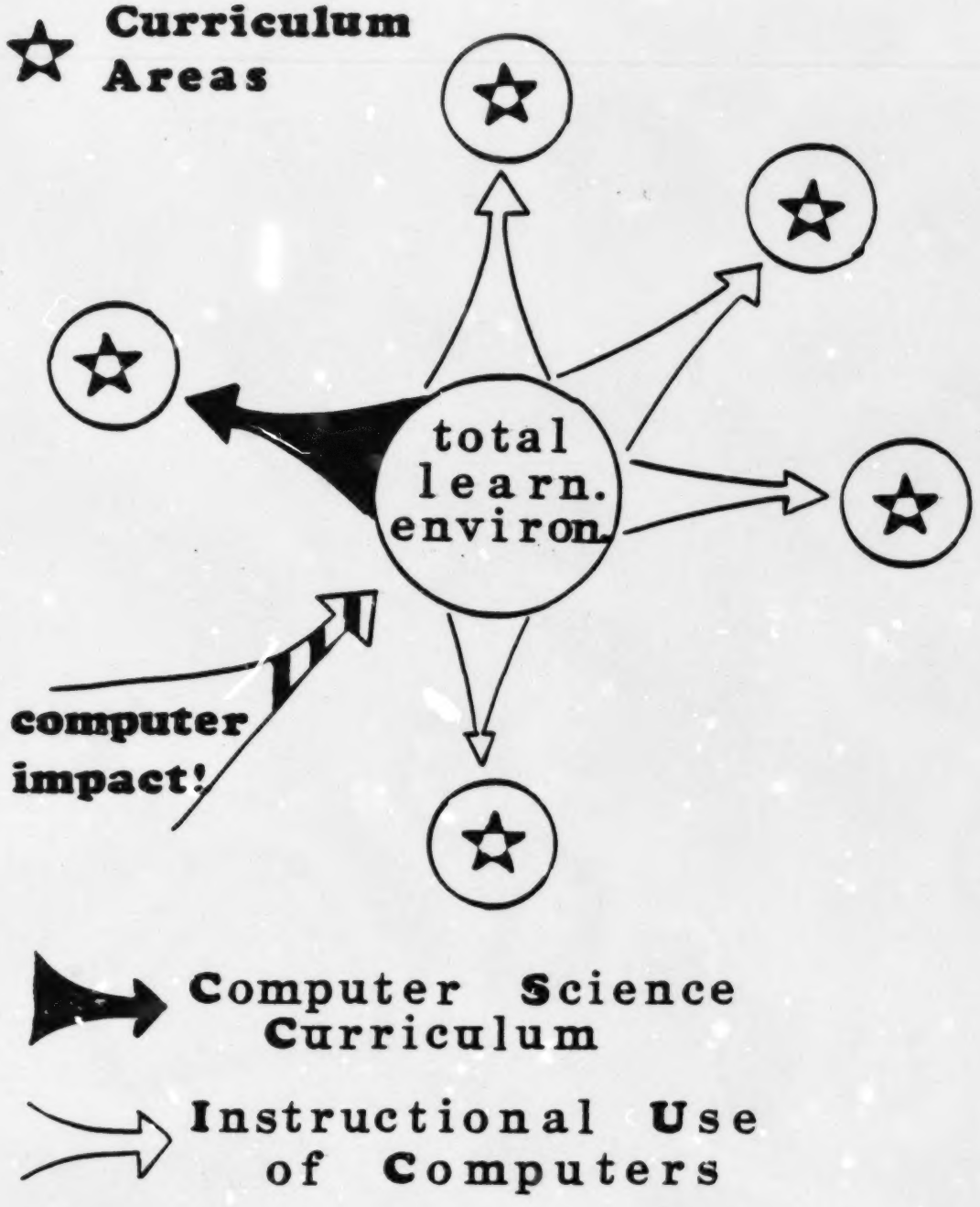
Summary

In general, it was discovered that the term computer literacy has acquired a variety of meanings in the educational community. To a small number, it still means a few hours of "hands-on" experience--learning to turn on and "run" a computer program. To others it means many hours of practice in developing programming skills. A majority in this study argued that learning a computer's capabilities and limitations required a broad range of "user skills" which center on the application of the computer through the knowledge of how to use a wide range of commercial software rather than trying to develop enough skillful programming techniques to emulate the software writers.

The last characterization above seems to be the generally accepted composite view of the teacher participants of the study. Figure 1 is a graphic representation which

FIGURE 1

THE EDUCATORS' DILEMMA



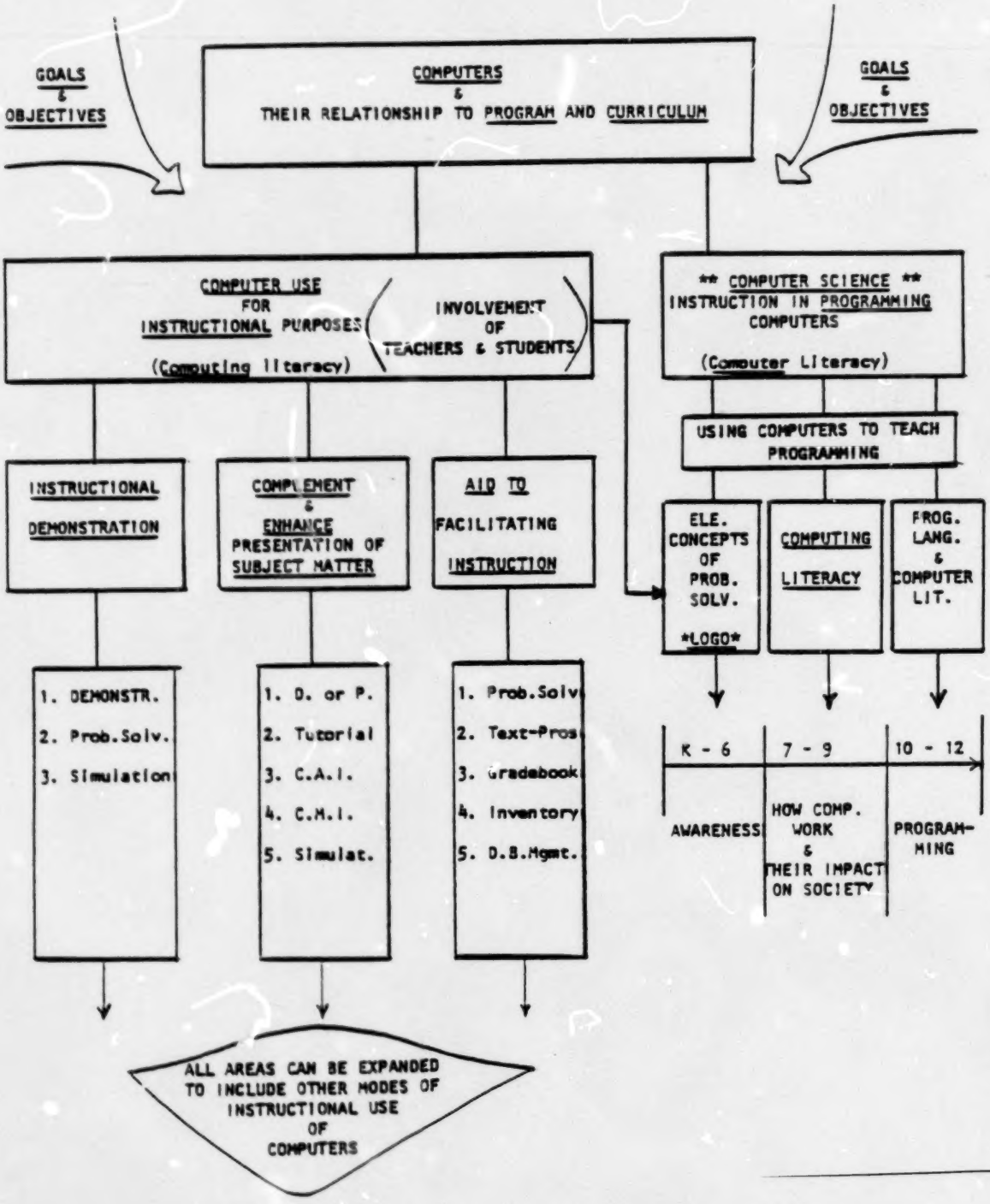
defines the dilemma which confronts educators. As is illustrated, the two major areas of concern with respect to the computer's influence on education were the curriculum subject of computer science and the impact of the computer as it crosses interdisciplinary bounds and becomes a tool with which to augment, enhance, and complement the total learning environment of the educational system.

The flow chart depicted in Figure 2 illustrates the design as it relates to the areas of curriculum affected by the impact of the computer. The key words which differentiate the areas could be "computer" versus "computing" literacy--meaning "computer literacy" as learning about computers as opposed to "computing literacy" which deals largely with the ability to use the computer, with skill, to expand, enhance, and complement the delivery of the educational goals and objectives in the broader educational setting.

As determined from a review of the pertinent literature relating to computers and their impact on the society in general and the educational community in particular, the present writer determined that there is a dearth of information with respect to which elements can be identified as components for course content in computer literacy. The most prominent study was done in 1978 by Madeline Baum. She identified certain components as important elements to be considered when developing computer literacy for teachers.

FIGURE 2

COMPUTERS AND THEIR RELATIONSHIP TO PROGRAM AND CURRICULUM



The list (Appendix C) of elements became, in part, the basis for Part II of the questionnaire.

The population demographics in Part I of the survey produced a well distributed variety of backgrounds and experience. The ages of the respondents ranged from a minimum of 25 years to a maximum of 66 plus years. One hundred and twelve of the repondents fell in the 30 to 40 years age group. Fifty-six females and 79 males participated. There was a balance of teachers in the grades one to nine group, 57, and 54 in the upper secondary group, grades 10 to 12. Others who participated were administrators, directors of computer services, and special services personnel. A total of 85 percent had more than five years of total teaching experience. Some 86 percent had less than six years teaching experience with computers. The respondents came from school populations varying in size from six districts having less than 100 students to 21 districts having more than 10,000 students.

The majority, over 90 percent, use the BASIC language. Slightly over 50 percent held a degree beyond the Baccalaureate. Of the respondents, 60 percent had formal training in the use of the computer, while 80 percent of that training amounted to less than 11 hours per respondent.

A review of Part II indicated that the respondents had definite opinions about some of the components which should comprise a computer literacy course. The data were analyzed

by determining that the two responses 5 (definitely needed) and 4 (should probably be included) were positive answers, while the other three responses were characterized as negative. A benchmark of two-thirds, or 66.7 percent, was used as the level of acceptability when judging each of the questions as a component to be considered in the overall study of computer literacy. The 27 questions judged by the respondents in Part II are presented here in three categories:

Category I

The acceptance level was 66.7 percent or above agreement among the respondents.

A course for teachers in computer literacy should have as a component a unit dealing with:

1. The availability of computerized teaching materials (i.e., instructional programs) in a variety of subject matter fields.

2. The integration of computerized teaching materials into existing curriculum, K-12.

3. The functioning of CMI (computer-managed-instruction) systems.

5. The application of compuerized drill or practice in a variety of teaching situations.

8. The uses of simulations as teaching tools.

9. The evaluation of the effectiveness of a course that uses computerized teaching materials.

10. Procedures for determining the computer needs of your school.

15. Procedures for using instructional games appropriately and effectively in teaching.

16. Hands on experience in the everyday operation and use of a range of different machines.

17. Hardware trouble-shooting procedures and means of access to professional help, i.e., knowing how to determine if a piece of equipment is ailing, and if it is, knowing who to call to fix it.

18. Identifying sources for computer materials (hardware, software, and supplies).

20. Techniques for evaluating the effectiveness of specific instructional computer programs.

22. The examination of alternative uses of computers in schools, e.g., as class-recordkeepers, term-paper-editors, etc.

26. Knowledge of where computer programming fits into the total area of computer literacy.

27. The techniques for teaching problem-solving, with the use of the computer as an aid.

Category II

The acceptance level was below 66.7 percent and above 50 percent agreement among the respondents.

A course for teachers in computer literacy should have as a component a unit dealing with:

14. The characteristics of instructional games.

21. The social role and impact of computers in society.

23. The potential values related to involving students in the development of computerized instructional materials.

25. The instructional uses of information retrieved from large data bases over telephone lines.

Category III

The acceptance level was below 50 percent agreement among the respondents.

A course for teachers in computer literacy should have as a component a unit dealing with:

4. The effective design of drill or practice material

6. The characteristics of computer simulations and models.

7. The preliminary design and construction of a simulation.

11. The drafting of specifications which set down the needs and desires of the school and invite proposals/bids from potential suppliers.

12. The critical review of suppliers' proposals and their machines.

13. The assembling of data about proposed equipment to facilitate decision-making (cost, performance data, hardware, software support, etc.)

19. The improvement of less-than-adequate instructional computer programs (i.e., detailed knowledge of computer programming).

24. Processes for involving students in the development of computerized instructional materials.

An examination of Part III of the questionnaire revealed a ranking of the five major concerns of teachers who were using the computer for instruction. These concerns are listed in order as follows:

1. Knowledge of Computer Assisted Instruction

2. Knowledge of Computer Managed Instruction

3. Knowledge of Software Evaluation

4. Knowledge of How and Where to Obtain Software

5. Knowledge of a Programming Language

A review of Part IV indicated that among the major concerns to teachers were the elements of hands on experience,

more courses and workshops which dealt with the use of commercial software, software evaluation, curriculum development and planning, and less emphasis on programming.

Conclusions

Based on the research of the study the following conclusions seem warranted.

1. Since the statistical t-test has been applied to the components in Part II of the survey and since the great majority of components have been rejected at the .05 significance level, it therefore appears that H(1)--There will be no significant difference in the content of courses presently offered for computer literacy and the perceived need of inservice teachers for course content--must be rejected.
2. Since an analysis of the data on the Part II questions varied substantially and since the course outlines from the institutions contained a wide range of different responses, it therefore can probably be concluded that the schools queried have several different approaches to course content.
3. Since the composite results of the teachers' questionnaire depicted indepth-programming as a negative response and since the majority of the institutions listed programming content as 60 to 70 percent of their course content, it therefore

seems appropriate to reject H(3)--that teachers' perceptions of course content leading to literacy and those of the institutions differ.

4. Since the statistical one-way ANOVA has been applied to each state and institution, and since very few of the components have been rejected at the .05 probability level, therefore it appears that the statistics must fail to reject H(4)--There will be no significant difference in the perceptions of the teachers, of the respective states, as to the components which are most needed to be incorporated in the course content for computer literacy.
5. Since there is a paucity of literature available as determined by the research, and since there is such a wide discrepancy between the teacher responses and institutional responses as to the components necessary to complete a course in computer literacy, it therefore seems appropriate to develop a model plan which will outline the components necessary to fill the need of inservice and preservice teachers in the area of computer literacy.

Recommendations--A Model Plan for Teacher Preparation in Computer Literacy

It seems appropriate that the results of the study be organized into a plan which can set forth guidelines for institutions as they prepare to meet the educational needs of preservice and inservice teachers who are going to use the computer as an instructional tool.

In the development of a syllabus which addresses content in computer literacy, the natural division would seem to be the areas of hardware and software. Each area has its special components which should be developed. It must be kept in mind that the components used here for teacher preparation are open ended. The plan would suggest, however, that a balance be maintained in the presentation of the material so that one component is not grossly over-emphasized. The model plan for teacher preparation in the instructional applications of computers is presented in Figure 3.

FIGURE 3

THE MODEL PLAN

TEACHER PREPARATION IN THE INSTRUCTIONAL APPLICATIONS OF COMPUTERS

The purpose of this plan is to provide an outline for a course which will expand a teacher's knowledge in a variety of computer applications within the educational setting. The syllabus is presented in outline form. The intent is that each topic be open-ended, but include, at the very least, the content listed below each area.

A. Knowledge and proficiency in the use of computer hardware and hardware systems and peripherals should include:

   1. Hands on experience with a range of different computing machines and their disk operating systems, as well as the associated peripheral devices. Specifically, training should include experience with:

      a. The popular microcomputers (APPLE, IBM-PC, TRS-80, etc.)

      b. Peripheral devices such as printers, storage devices, modems, and graphics tablets

      c. Firmware cards such as clock cards, RAM cards, music synthesizers, and ROM chips

   2. Hardware trouble-shooting skills for microcomputers.

      a. The minor testing and diagnostics of potential trouble areas and the ability to determine when a device actually has to be serviced by professionals should be included.

   3. Techniques in identifying and locating hardware sources based upon the latest information available.

      a. A teacher should know where to obtain the literature and where to locate users of specific and various types of equipment.

   4. The development of procedures for organized and sequential planning in the selection of computer hardware.

B. Knowledge and proficiency in the instructional applications of computer software and courseware should include:

1. Programming the computer.

   a. Specifically, training should include an initial and cursory development of simple programming techniques. The approach should be to offer a survey of the several languages being used in the educational community. The programming experience should not be an indepth study of subroutines, recursion, POKES, and PEEKS of any one language.

2. The development of materials research skills.

   a. The development of techniques for the organized selection and acquisition of applications software and courseware for the entire curriculum, K-12, should be covered.

3. Software in course evaluation. Special training should include experience in:

   a. The development of techniques for the selection of courseware for use in the curriculum.

   b. The development of techniques to provide for the on-going evaluation of the effectiveness of a course that uses computerized teaching materials.

4. Techniques for the integration of courseware into the curriculum. Training should include experience in:

   a. Developing techniques for the application of drill and practice in a variety of teaching situations.

   b. Developing techniques for using instructional games appropriately and effectively in teaching.

   c. Developing techniques for the appropriate use of simulations as teaching tools.

   d. Developing techniques for the teaching of problem-solving using the computer as a tool and aid.

e. Developing techniques for the assessment of when and to what degree computer programming should be attempted in the area of computer literacy.

5. Classroom management applications of the computer.

   a. The course should develop techniques for the application of data base management and word-processing software, as well as other general software packages, to accomplish other classroom management procedures such as: classroom inventory, grade recording, test and worksheet construction and revision.

6. The operations of classroom management software and systems.

   a. The course should allow one to gain experience in the use of examples of classroom management systems and practice in setting up and running a management system.

(If time permits):

C. Knowledge of future capabilities and limitations of the computer should include:

   1. Discussions of future developments in the capabilities of computers--the advancement of technology--and the possibilities for future use in a wide variety of situations and applications such as information utilities.